

(Status of) The search for ν_μ to ν_e oscillations at MiniBooNE

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WIN03 – Weak Interactions and Neutrinos
Lake Geneva, Wisconsin

MiniBooNE status snapshot

MiniBooNE has been running for 1 year at Fermilab
acquired 15% of goal 10^{21} protons on target

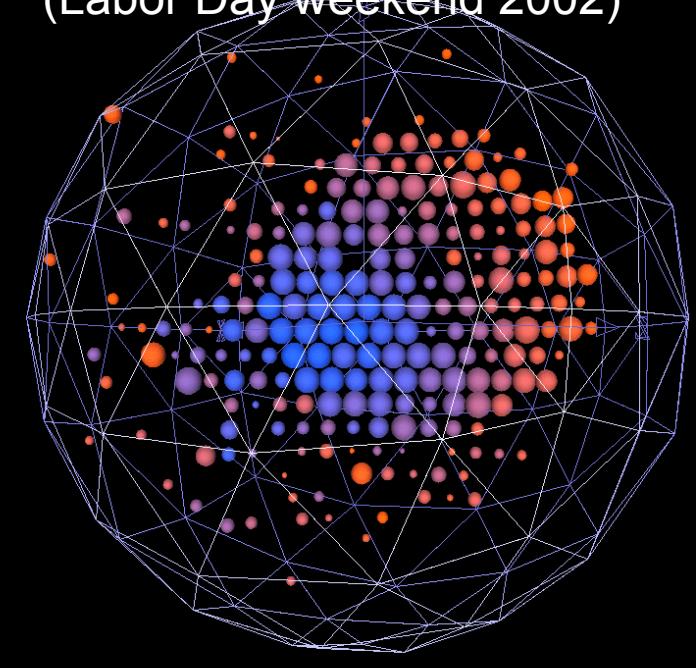
At the moment (Sept – mid Nov) accelerator is shutdown
important accelerator improvements are underway

Outline

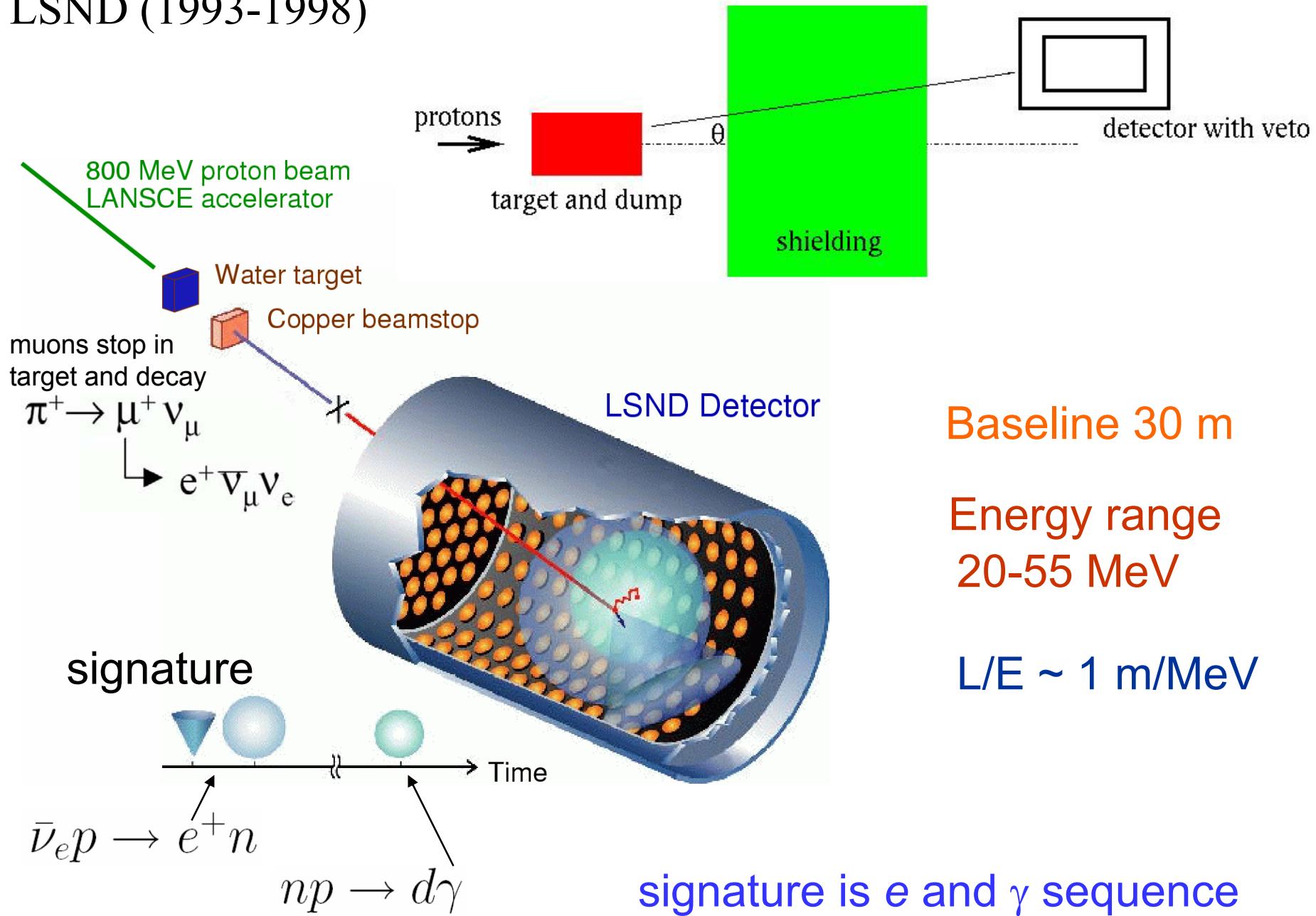
Overview of the experiment
(preview of tomorrow's tour)
First neutrino events and analysis

Outlook

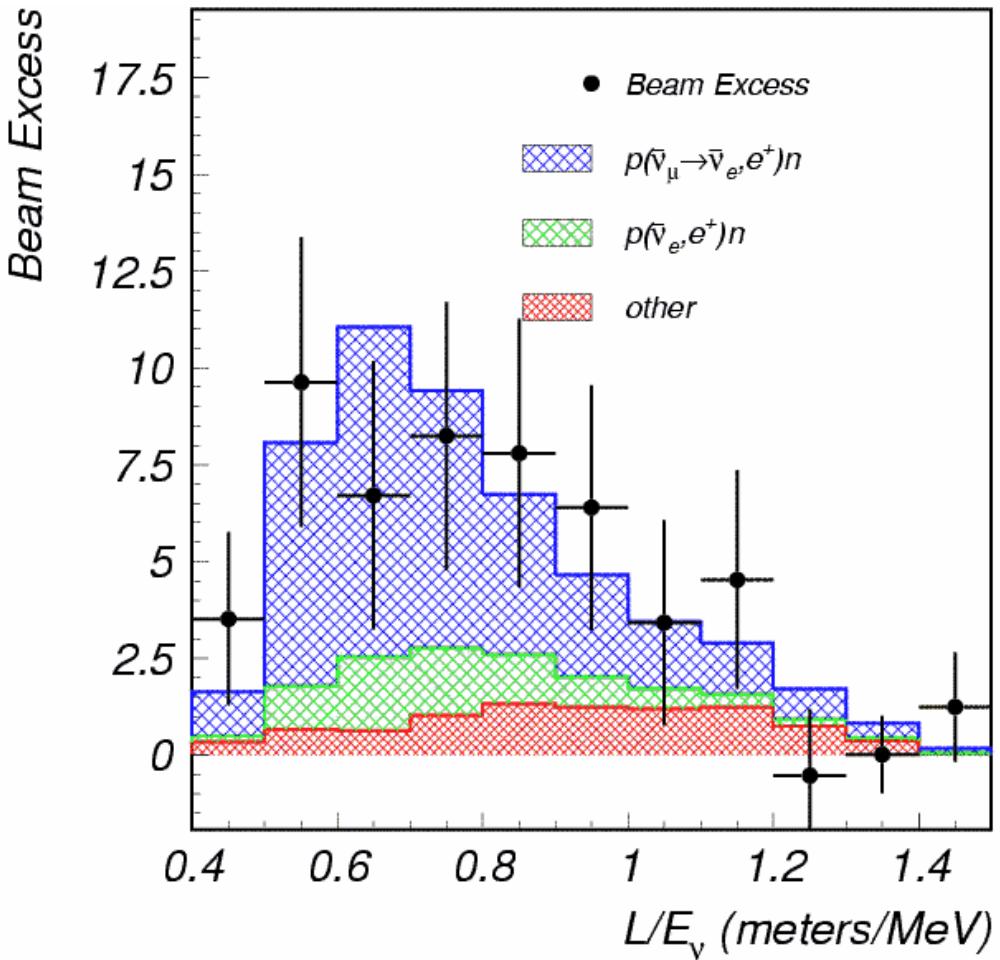
MiniBooNE's first event:
beam-induced muon
(Labor Day weekend 2002)



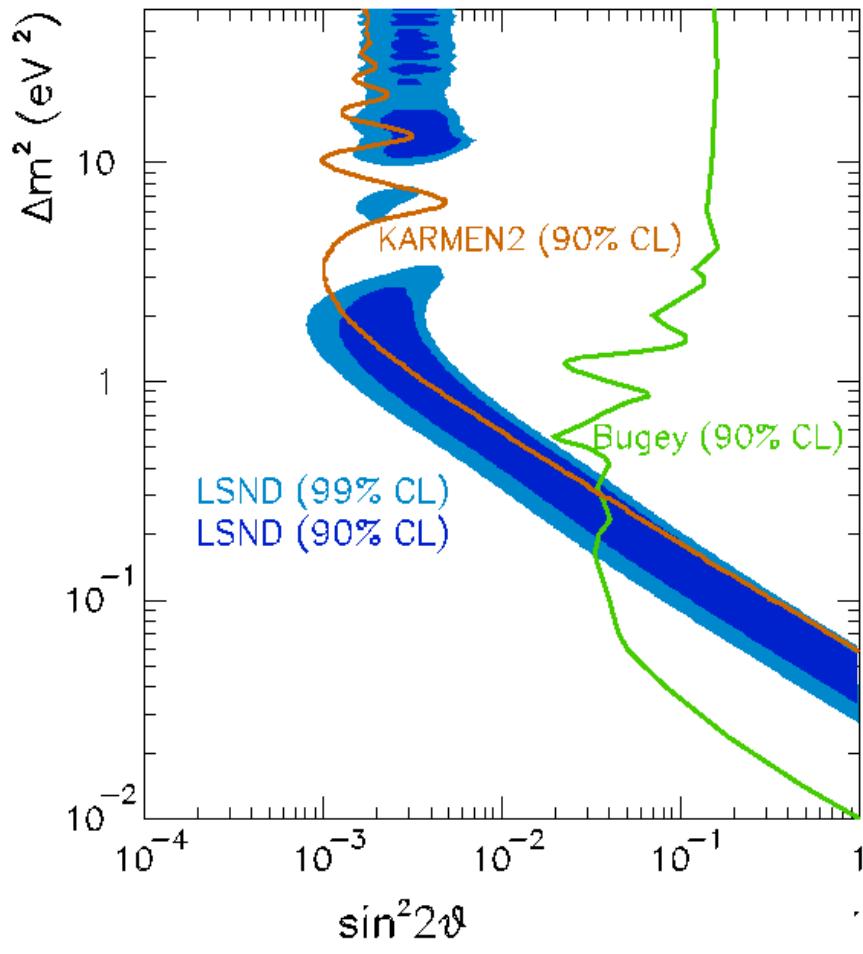
LSND (1993-1998)



LSND: Evidence for $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$



$87.9 \pm 22.4 \pm 6.0$ events



$\Delta m^2 \sim 0.2-10$ eV²

(Bugey is $\bar{\nu}_e$ disappearance)

Too many Δm^2 's?

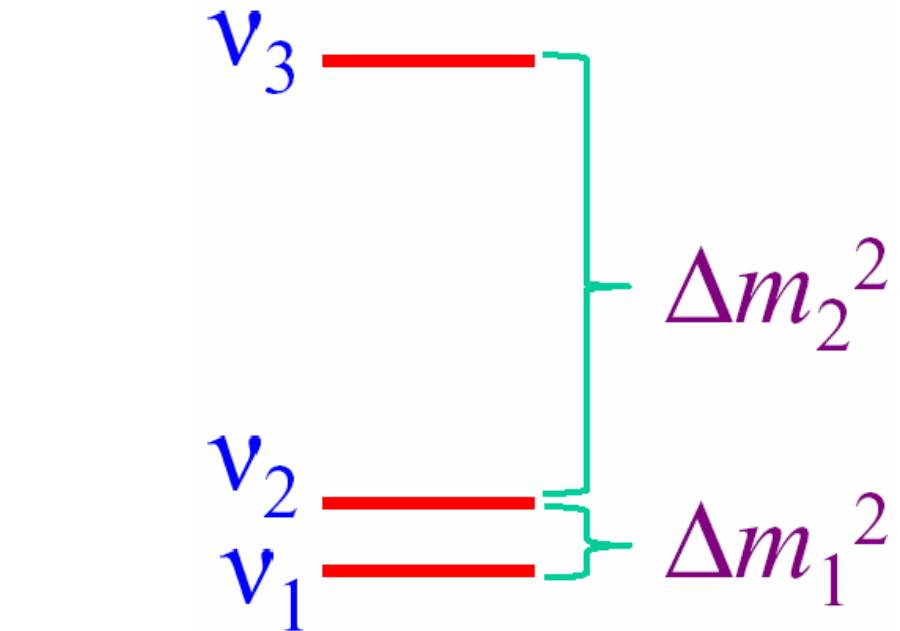
3 light neutrino flavors

Solar neutrinos:

- $\Delta m^2 \approx 7 \times 10^{-5} \text{ eV}^2$
- mostly $\nu_e \rightarrow \nu_{\mu,\tau}$

Atmospheric neutrinos:

- $\Delta m^2 \approx 2 \times 10^{-3} \text{ eV}^2$
- mostly $\nu_\mu \rightarrow \nu_\tau$



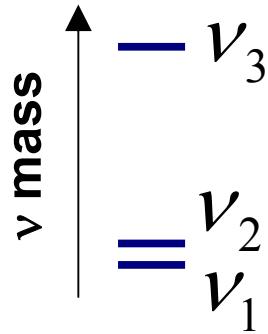
$$\Delta m_3^2 = \Delta m_1^2 + \Delta m_2^2$$

Where does LSND's $\Delta m^2 \sim 0.2\text{-}10 \text{ eV}^2$ fit in this picture??

ν Oscillation Scenarios:

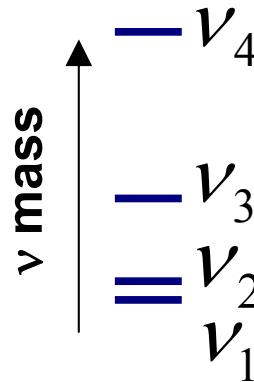
With current results from solar, atmospheric, and LSND ν -oscillation searches (3 Δm^2 s), we have an interesting situation:

Only 3 active ν :



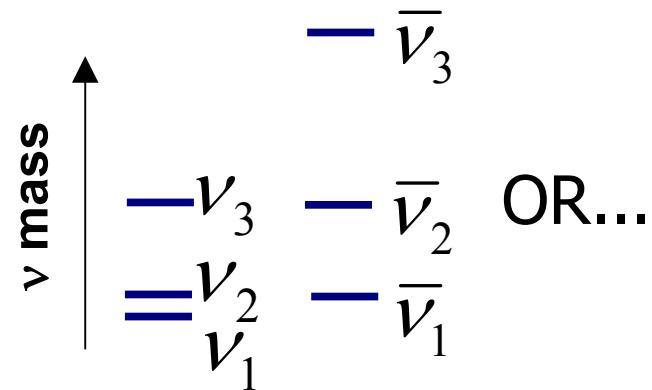
OR...

3 active+1 sterile ν :



OR...

CPT violation:



solar: $\nu_e \rightarrow \nu_\mu$

atmos: $\nu_\mu \rightarrow \nu_e, \nu_\tau$

LSND: $\bar{\nu}_\mu \rightarrow \bar{\nu}_\tau \rightarrow \bar{\nu}_e$

- not a good fit to data

solar: $\nu_e \rightarrow \nu_\mu, \nu_\tau$

atmos: $\nu_\mu \rightarrow \nu_\tau$

LSND: $\bar{\nu}_\mu \rightarrow \bar{\nu}_s \rightarrow \bar{\nu}_e$

- possible(?)

solar: $\nu_e \rightarrow \nu_\mu$

atmos: $\nu_\mu \rightarrow \nu_\tau$

LSND: $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$

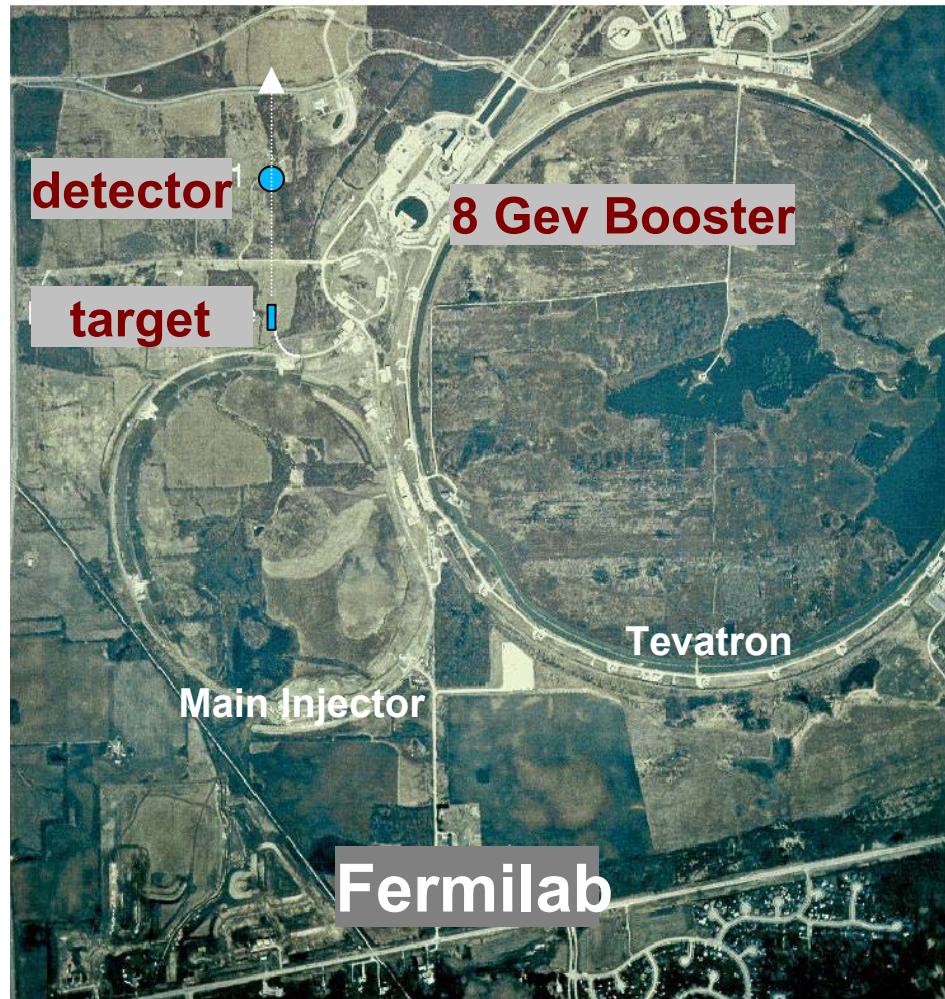
- possible(?)

Need to definitively check the LSND result.

Goal: test LSND with
5- σ sensitivity over
whole allowed range

- higher statistics
- different signature
- different backgrounds
- different systematics

MiniBooNE!



BooNE: Fermilab Booster Neutrino Experiment

First phase: “MiniBooNE”

- Single detector, $\nu_\mu \rightarrow \nu_e$ appearance
- $L/E = 500\text{ m}/500\text{ MeV} = 30\text{ m}/30\text{ MeV}$ (LSND)

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